

REMARKS

Claims 1, 2, 5-52 and 57-62 are pending in the subject application. Claims 39-51 are withdrawn from consideration. Claims 1, 2, 5-38, 52, and 57-62 are examined on the merits. In the Office Action ("Action") of October 27, 2009, claims 1, 2, 5-38, 52, and 57-62 stand rejected.

Claims 2, 52, and 62 stand rejected under 35 U.S.C. § 112, second paragraph, as being indefinite. Claims 1, 2, 5-38, 52, and 57-62 stand rejected under 35 U.S.C. § 102(b) as being anticipated by European Patent Application EP 1 555 273 A1 to Matyjaszewski et al. ("EP '273"). Claims 1, 2, 5-38, 52, and 57-62 also stand rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 6,162,882 to Matyjaszewski et al. (the "882 patent"). Applicants traverse these rejections as set forth herein.

Rejections under 35 U.S.C. § 112, Second Paragraph

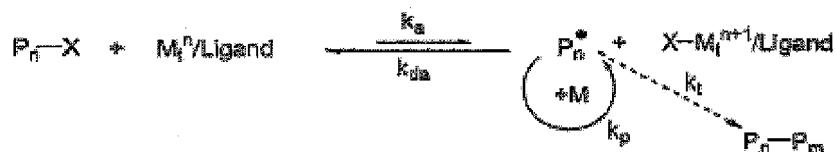
Claims 2 and 52 stand rejected in the Action for being indefinite. Specifically, the Office states that the term "significantly" is relative and therefore indefinite. Applicants have amended claims 2 and 52 to delete the term "significantly", thereby rendering the claims definite.

Claim 63 stands rejected in the Action as lacking proper antecedent basis for the term "the atom transfer radical reaction process". Claim 63 is amended to recite "wherein the ~~atom transfer radical reaction~~ polymerization process is...". The "polymerization process" has antecedent basis in claim 52 from which claim 63 ultimately depends. Withdrawal of the rejection of claims 2, 52, and 63 under 35 U.S.C. § 112, second paragraph, is respectfully requested.

Rejection over EP 1 555 273

Claims 1, 2, 5-38, 52 and 57-62 stand rejected under 35 U.S.C. § 102(b) as being anticipated by EP '273. A claim is anticipated under § 102(b) only if each and every element as set forth in the claim is described, either expressly or inherently, in a single prior art reference. See MPEP § 2131. Applicants traverse this rejection for at least the reasons set forth herein.

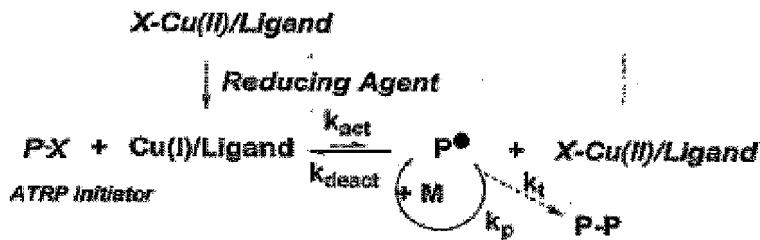
Applicants respectfully submit that the Action fails to identify any portion of EP '273 that teaches a reducing agent as recited in claim 1, as amended. The examiner characterizes EP '273 as describing an initiating system comprising, in part, a transition metal compound which participates in a reversible redox cycle (i.e., with the initiator) and an amount of the redox conjugate of the transition metal compound sufficient to deactivate at least some initially-formed radicals. EP '273 teaches that the term "redox conjugate" refers to "the corresponding oxidized or reduced form of the transition metal catalyst." EP '273, paragraph [0055]. The redox cycle is shown in Scheme 1 and described in paragraphs [0010]-[0012] of the subject application:



Scheme 1. General mechanism for the ATRP process

As shown in Scheme 1, the redox conjugate, M_t^{n+1}/Ligand , participates in a repetitive redox reaction homolytically removing a radically transferable atom or group, $-X$, from an initiator molecule or dormant polymer chain, P_n- , to form the active propagating species, P_n^* , and then deactivating active propagating species by donating back a transferable atom or group. The redox cycle forms products that participate in control of the polymerization process, such as an active propagating species, an ATRP catalyst, or an ATRP initiator.

Claim 1 has been amended to clarify that "the reducing agent is capable of reducing the at least one transition metal catalyst from an oxidized, inactive state to a reduced, active state"; and "[an] oxidized reduction product does not participate in control of the polymerization process." As shown in Scheme 4 and described in paragraphs [0066]-[0067] of the subject application, the reducing agent is capable of reducing the transition metal catalyst from the oxidized, inactive state, $X-\text{Cu(II)}/\text{Ligand}$, to the reduced, active state, $\text{Cu(I)}/\text{Ligand}$. The transition metal in the reduced, active state can then catalyze the polymerization reaction.



Scheme 4. Proposed Mechanism.

Applicants have observed radical-radical coupling between $P\bullet$ to $P-P$. The ATRP process generally minimizes radical-radical coupling due to the low concentration of active radical. However, when the radical-radical coupling occurs, it leads to a buildup of the transition metal catalyst in the oxidized, inactive state, *i.e.*, $X\text{-Cu(II)/Ligand}$ in Scheme 4. This may lead to decreased polymerization efficiency and increases the amount of catalyst necessary for an effective polymerization. Applicants have found that by adding a reducing agent that can reduce the transition metal catalyst from the oxidized, inactive state to the reduced, active state, more efficient catalysis is observed and less catalyst is required to affect polymerization.

After the reducing reaction, the reducing agent does not form a reduction product that participates in control of the polymerization process, such as an active propagating species, an ATRP catalyst, or an ATRP initiator, and therefore, does not subsequently affect the reaction. For example, as shown in Scheme 3, the reduction product, $\text{Sn(EH)}_2\text{Cl}_2$, is not an active propagating species, an ATRP catalyst, or an ATRP initiator and will not affect the polymerization process.



Scheme 3. Reduction of $\text{Cu}^{(II)}$ to $\text{Cu}^{(I)}$ by tin^(II) 2-ethylhexanoate.

In contrast, EP '273 only discloses the transition metal catalyst which participates in the reversible redox cycle. Accordingly, Applicants submit that EP '273 fails to describe all of the elements as presently claimed in independent claim 1. Since rejected claims 2, 5-38, 57 and 58 depend, directly or indirectly, from independent claim 1, Applicants also

submit that EP '273 fails to describe all of the elements of claims 2, 5-38, 57 and 58 for at least the reasons discussed above.

Applicants respectfully submit that the Action fails to identify any portion of EP '273 that teaches a reducing agent as recited in claim 52. Claim 52 recites, in part, the reducing agent reacts with at least one of the transition metal catalyst and a compound comprising a radically transferable atom or group to form a compound that does not participate in control of the polymerization process. As discussed above, Applicants submit that EP '273 fails to teach a reducing agent. Accordingly, Applicants submit that EP '273 fails to describe all of the elements as presently claimed in independent claim 52. Since rejected claims 59-62 depend, directly or indirectly, from independent claim 52, Applicants also submit that EP '273 fails to describe all of the elements of claims 59-62 for at least the reasons discussed above. Withdrawal of the rejection under 35 U.S.C. § 102(b) over EP' 273 is respectfully requested.

Rejection over U.S. 6,162,882

Claims 1, 2, 5-38, 52 and 57-62 stand rejected under 35 U.S.C. § 102(b) as being anticipated by the '882 patent. Applicants traverse this rejection for at least the reasons set forth herein.

Applicants respectfully submit that the Action fails to identify any portion of the '822 patent that teaches a reducing agent as recited in claim 1, as amended. The examiner characterizes the '882 patent as teaching:

Any transition metal compound which can participate in a redox cycle with the initiator and dormant polymer chain, but which does not form a direct carbon-metal bond with the polymer chain, is suitable for use in the present invention. Preferred transition metal compounds are those of the formula $M_t^{n+}X_n^r$, where: M_t^{n+} may be selected from the group consisting of Cu^{1+} , Cu^{2+} , Fe^{2+} , Fe^{3+} , etc (col., 10 line 57 through col. 11, line 15).

As discussed above, the transition metal forms a redox conjugate, M_t^{n+1}/Ligand , that participates in a repetitive redox reaction in which the reduced catalyst is an active propagating species that participates in control of the polymerization process. Claim 1 has been amended to clarify that the added reducing agent is capable of reducing the at least one transition metal catalyst from an oxidized, inactive state to a reduced, active

state, and the oxidized reduction product does not participate in control of the polymerization process. Accordingly, Applicants submit that the '882 patent fails to describe all of the elements as presently claimed in independent claim 1. Since rejected claims 2, 5-38, 57 and 58 depend, directly or indirectly, from independent claim 1, Applicants also submit that the '882 patent fails to describe all of the elements of claims 2, 5-38, 57 and 58 for at least the reasons discussed above.

Applicants respectfully submit that the Action fails to identify any portion of the '882 patent that teaches a reducing agent as recited in claim 52. Claim 52 recites, in part, the reducing agent reacts with at least one of the transition metal catalyst and a compound comprising a radically transferable atom or group to form a compound that does not participate in control of the polymerization process. As discussed above, Applicants submits that the '882 patent fails to teach a reduction product that does not participate in control of the polymerization process. Accordingly, Applicants submit that the '882 patent fails to describe all of the elements as presently claimed in independent claim 52. Since rejected claims 59-62 depend, directly or indirectly, from independent claim 52, Applicant also submits that the '882 patent fails to describe all of the elements of claims 59-62 for at least the reasons discussed above. Withdrawal of the rejection under 35 U.S.C. § 102(b) over the '882 patent is respectfully requested.

CONCLUSION

Accordingly, Applicants have made a diligent effort to fully respond to the Action presented by the examiner. Applicants request favorable reconsideration of the Subject Application and the issuance of a Notice of Allowance at an early date.

Applicants do not acquiesce to any of the specific rejections, assertions, and statements presented in the Office Action that have not been explicitly addressed herein. Applicants reserve the right to specifically address all such rejections, assertions, and statements in continuing applications, subsequent responses, and in appeal or pre-appeal proceedings.

If the examiner has any concerns regarding Applicants' present response, the Examiner is invited to contact Applicants' undersigned representative at the telephone number listed below so that those concerns may be expeditiously addressed. The Office is authorized to charge any additional fee necessary for consideration of this response to Deposit Account 11-1110.

Respectfully submitted,

Date 03-29-2010



Michael E. Dukes
Attorney for Applicants
Registration No. 59,878

K&L Gates LLP
K&L Gates Center
210 Sixth Avenue
Pittsburgh, PA 15222-2613
Phone: 412-355-6338
Fax: 412-355-6501
Customer No. 27752